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UNITED STATES DEPARTMENT OF AGRICULTURE  
SYLLABUS 24

Contribution from the States Relations Service  
A. C. TRUE, Director  
In Cooperation with the Bureau of Plant Industry  
WM. A. TAYLOR, Chief

Washington, D. C.

February 15, 1917

ILLUSTRATED LECTURE ON  
LEGUMINOUS FORAGE CROPS FOR  
THE SOUTH

By

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Investigations, Bureau of Plant Industry, and  
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WASHINGTON  
GOVERNMENT PRINTING OFFICE  
1917



# U. S. DEPARTMENT OF AGRICULTURE,

## STATES RELATIONS SERVICE.

A. C. TRUE, Director.

In cooperation with the Bureau of Plant Industry, Wm. A. Taylor, Chief.

### SYLLABUS 24—ILLUSTRATED LECTURE ON LEGUMINOUS FORAGE CROPS FOR THE SOUTH.<sup>1</sup>

By CHARLES V. PIPER, *Agrostologist in Charge of Forage Crop Investigations, Bureau of Plant Industry*, and H. B. HENDRICK, *Specialist in Agricultural Education, States Relations Service*.

#### INTRODUCTION.

From the earliest days of agriculture farmers have observed that the clovers, alfalfa, beans, and peas enriched the soil so that wheat, corn, cotton, and similar crops gave better yields following them than when planted after the grains or grasses. The reason for this benefit to the soil, however, is of recent discovery and the broader practical application of the knowledge is just beginning to be made effective.

"South," as used in the title of this lecture, means the agricultural south, which is, approximately, that part of the United States south of the northern boundary of profitable cotton culture.

View.

1

#### DISTINGUISHING CHARACTERISTICS OF LEGUMINOUS PLANTS.

Leguminous plants are readily distinguished, in most instances, by the characteristic form of their flowers, of which the garden pea is typical, and by the seed-bearing pods which split upon ripening at both edges or sutures. The most important difference, however, between leguminous and non-leguminous crop plants as they affect the fertility of soil is the formation of nodules or tubercles, normally attached to the roots of thriving plants of the legume family. These nodules vary greatly in size and shape. On the roots of red clover they are about the size of a pin head and ovoid in form; on alfalfa they are somewhat larger and irregular in shape.

2

<sup>1</sup> This syllabus has been prepared in direct cooperation between the Office of Forage Crop Investigations of the Bureau of Plant Industry, as regards subject matter, and J. M. Stedman, Farmers' Institute Specialist of the States Relations Service, as regards pedagogical form. It is designed to aid farmers' institute and other extension lecturers in presenting the subject before popular audiences. The syllabus is illustrated with 50 lantern slides. The numbers in the margins of the pages refer to the lantern slides as listed in the Appendix.

- View. frequently forming in egg-shaped masses, the aggregate of which may be the size of a very small marble, while on soy  
 3 beans the nodules resemble the seeds of the common pea both in size and shape. For many years and until comparatively recent times these nodules were thought to be a form of root-gall disease. In 1886 the scientists Hellriegel and Wilfarth discovered their real function in relation to the plants and to the soil.

#### FUNCTION OF ROOT NODULES AND NODULE BACTERIA.

- If a nodule on a living plant be cut open and some of the juicy substance in it be spread thinly upon a glass slide, examination under a high-power microscope will reveal an immense  
 4 number of living single-celled organisms of the kind called bacteria. These nodule-forming bacteria, when in the soil, pass into the minute root hairs of leguminous plants during their early growth and establish themselves in the outer layer of cells of the true roots, where they multiply rapidly and form the enlargements called nodules. The relation of nodule bacteria to the host plant is symbiotic: that is, the two are mutually helpful. The plant furnishes a home for the bacteria and the bacteria in turn manufacture food for the plant.

- Plants, like animals, require food materials for growth. Among the most important plant foods are compounds of the element nitrogen, which as an invisible gas comprises about four-fifths of the atmosphere. Nitrogen can not be taken in  
 5 directly by the leaves of plants as is carbon dioxid, but must first be combined with other elements to form soluble compounds of nitrogen which can be readily absorbed by the roots. The nodule bacteria of leguminous plants use nitrogen directly from the air as it circulates in the soil and convert it into nitrogenous compounds which are utilized in the growth of the plants.

- Nonleguminous crops, including corn and other grains, cotton, and the grasses, secure all of the nitrogen for their growth from the soil. All leguminous crops, under normal conditions, obtain a large part of their nitrogen through bacterial action directly from the air, and in general they contain  
 6 a larger percentage of nitrogen and consequently make richer feeds than nonlegumes.

#### INOCULATION.

When a leguminous crop that has not been grown in a field is planted for the first time nodule-forming bacteria of the



right kind probably will not be in the soil and should be supplied. If not supplied, only a few nodules are apt to develop, in which case the plants must secure nearly the entire supply of nitrogen for growth from the soil. The process of furnishing bacteria to the soil for such purpose is called *inoculation*. View.

#### SOIL-TRANSFER METHOD.

A practical and effective method of introducing inoculation is to transport soil from a field containing the bacteria needed. Soil from fields of alfalfa, sweet clover, and bur clover is interchangeable as regards inoculation: likewise from red, alsike, crimson, and white clovers; also from fields of the vetches and field peas. In the case of cowpeas and soy beans, however, each requires its particular strain of bacteria for inoculation. Soil for inoculation should be free from obnoxious weeds. It should be taken from the first 5 or 6 inches of the surface and spread at the rate of 200 to 400 pounds per acre on the field to be sown. Nodule bacteria are killed by much strong sunlight, so the inoculating soil should be spread during cloudiness, early morning, or late afternoon, and harrowed in soon after. 7

#### SOIL-COATING METHOD.

Where inoculating soil is scarce, economy may be practiced by making a thin mixture of chip glue and water, sprinkling this over the seed to be sown at the rate of about a quart of the liquid to a bushel of seed, then mixing enough of dry, inoculated soil with the seed to make it sufficiently dry to sow well. The inoculated soil thus becomes coated over the surface of the seed and is carried into the soil with the seed. 8

#### LIQUID-CULTURE METHOD.

Another very convenient and generally satisfactory way of inoculating soil is by means of the bacterial liquid cultures, a limited supply of which may be secured free upon application to the United States Department of Agriculture. Many of the State experiment stations sell these cultures at a price sufficient to cover cost of production, and liquid cultures are also sold by commercial firms. Directions for the use of the cultures accompany all shipments of this material. 9

### THE RELATION OF LEGUMES TO CROPPING SYSTEMS.

Leguminous plants, because of their relation to nitrogen-fixing bacteria, are called nitrogen gatherers. If leguminous crops are not grown as a part of the cropping system of a farm

View. the nitrogen supply of the soil is apt to become depleted, especially where nitrogenous fertilizers are not purchased and freely used. The latter way of keeping up the nitrogen is expensive and is seldom profitable, except for truck gardening or  
 10 other intensive farming. The safer and more practical way in most instances is to maintain the supply of nitrogen by growing legumes, which, besides furnishing nitrogen, keep up the needed humus supply in the soil. Every second to fourth crop in the rotation should be leguminous, depending upon whether the soil is generally fertile; whether the crops of the farm are chiefly sold or fed, and, in the latter case, whether the manure produced is carefully preserved and returned to the soil.

The place which leguminous crops should occupy in any cropping system must depend upon the crops of the rotation, length of the growing season, and the legumes grown. The best returns are realized, as a rule, by following legumes with strong-growing cultivated crops, such as corn, cotton, potatoes, or tobacco. Winter grain crops may well follow cowpeas or soy beans, and the nitrogen which is fixed in the soil by the  
 11 legumes is valuable to the early growth of these grain crops.

From the farming standpoint leguminous crops may be classified in three groups: (1) Warm-season annuals, which include cowpeas, soy beans, peanuts, and velvet beans; (2) cool-season annuals, such as crimson clover, bur clover, hairy vetch, and field peas; and (3) biennials and perennials, including alfalfa, sweet clover, alsike clover, red clover, and white clover. The purpose which the legume is to serve on the farm must determine from which group it should be selected.

#### COMMENDABLE CROPPING SYSTEMS.

In the corn and cotton sections of the South legumes should be grown to fill in between the principal money crops, to furnish hay and pasture for the farm stock, to prevent washing by covering the soil during the rainy season, and to make the farm  
 12 more fertile and productive. Where the growing of corn or cotton one year following another on the same field can not be avoided, crimson clover or bur clover should be sown at the last cultivation of these crops to serve as a cover crop and to furnish a green manure for the next regular crop. In the boll-weevil sections, where early planting of the cotton is necessary, crimson or bur clover will not make a large growth before the ground must be plowed for another crop of cotton, but even in this case it is well worth while to provide a cover crop. Where corn as a money crop is continuous, instead of planting in the



usual way and following with a cover crop, the distance between the rows may be widened and rows of cowpeas, peanuts, soy beans, or velvet beans may be sown at the proper time alternately with the rows of corn. After the corn is harvested the legumes may be hogged down, whereupon a cover of winter vetch and rye may still follow. View.  
13

A two-year rotation of cotton and corn as the basic crops is much better than continuous culture of either of these crops alone. In this rotation, cotton should always be followed with crimson clover, bur clover, or winter vetch and rye as a cover and green-manure crop; the rows of corn should be alternated, when desirable, with a suitable legume to be hogged off, but in all cases should be followed with a clover, hairy vetch, or vetch and rye cover crop. This cropping system affords considerable winter pasture from the fields regularly cropped and at the same time maintains a store of nitrogen and humus in the soil. 14

A still better cropping system than the one just outlined is a rotation of cotton, corn, and winter oats in the order given. In this cropping plan, a cover crop as heretofore given should follow the cotton crop. The oats should be sown following the corn. Lespedeza or vetch may be seeded with oats and will furnish pasture or hay after the oats are harvested; or, following the oats, cowpeas or soy beans may be put in as a catch crop. 15

In Maryland, Virginia, West Virginia, Kentucky, and Missouri, States in which more general farming is practiced, cropping systems somewhat different from the above may be recommended. Corn, wheat, and clover is a common rotation in these States. The corn crop should be followed by a cover of crimson clover or hairy vetch and rye. Barley, winter oats, or rye may be substituted for wheat in this rotation. Another good rotation for these States is corn, cowpeas or soy beans, wheat or other grain, and clover. The corn should be followed by a cover crop. Cowpeas or soy beans are grown as a regular hay crop and when removed the ground may be prepared easily without plowing for sowing to grain. Should the clover seeding fail from any cause, the field may be carefully prepared following the harvest of the grain and reseeded. In tobacco sections any portion of the field usually planted to corn may be used for tobacco. When more corn than this rotation provides is needed, corn may be planted in a field two years in succession without serious detriment, in case cover crops always follow the corn. 16  
17

View. When a field of alfalfa or other permanent meadow or pasture is wanted where any regular cropping system is carried out, any suitable field of the farm may be used for this purpose and later the field may be worked into the regular rotation by planting it first to corn and following in regular order with the other crops.

#### UTILIZATION OF LEGUMINOUS CROPS.

Unquestionably the best way to dispose of forage crops is to feed them to live stock. Legumes are rich in nitrogen compounds, or protein, and furnish exceptionally good feeds for all kinds of live stock. Alfalfa has been successfully substituted, in part, for such concentrates as wheat bran and cottonseed meal for feeding both dairy and beef cattle. Good cow-pea or soy-bean hay is about equal in feeding value to alfalfa. Alsike clover, bur clover, lespedeza, and sweet clover are not quite equal to alfalfa for feeding, but are all much more valuable for milk production or growing young stock than are timothy, redtop, Bermuda grass, or other nonlegumes.

There should always be a good mixture of leguminous plants in every permanent pasture. This is essential in order that the stock pastured may give the best possible returns, and also that the fertility of the soil may be conserved. Some of the best legumes for pasture mixtures in the South are lespedeza, bur clover, white clover, alsike clover, and vetch.

From 75 to 90 per cent of the total fertilizing matter of feeds consumed by animals is voided in the manure. Manures produced from feeding leguminous crops, as heretofore stated, are richer in nitrogen and hence of greater fertilizing value than those resulting from nonleguminous feeds. However, it is necessary to apply manure promptly, avoiding all possible losses from leaching, fire-fanging, etc., in order that the soil may approximate the benefits possible from the freshly voided manure.

As has been shown, three distinct advantages result from the growing and proper utilization of leguminous crops: (1) They add nitrogen to the soil directly through bacterial action in the root nodules; (2) they furnish excellent feed for growing animals and for milk and beef production; and (3) they yield particularly rich manures when fed to live stock.

#### LEGUMES AS GREEN MANURES.

When for any reason enough live stock to provide the manure required to keep the soil well supplied with humus can not profitably be kept on the farm, it is necessary to provide

some crops to return to the soil as a substitute. Crops grown for this purpose are called green-manure crops. Legumes have a great advantage as green manures over other plants inasmuch as they increase the nitrogen of the soil in which they grow as well as supply humus. Perennial legumes root more deeply than grains and grasses and so are more beneficial in loosening the soil. Where the system of farming and the soil are such as to make green manuring necessary it should be managed, if possible, so that one crop each year may be harvested and still leave opportunity for a green-manure crop. This plan can often be carried out successfully by means of catch crops and cover crops.

View.

21

A crop that is sown following the main crop of a season is called a catch crop. Only early maturing crops such as the grains, early potatoes, etc., are harvested in time to warrant following with a catch crop. Cowpeas and soy beans are perhaps the best legumes for catch crops in the South. If grain stubble be turned under and the ground well prepared for planting soon after harvest, cowpeas or soy beans may still be sown early enough to secure a good quantity of green manure; or, where live stock is kept, the catch crop may be pastured before turning under. After digging an early crop of potatoes the soil may be prepared, without plowing, and sown to a catch crop.

22

23

A crop sown to occupy the ground during the interval between the growing of regular crops is called a cover crop. A winter cover crop is of value (1) in taking up during its growth available plant food which otherwise might be leached from the soil and lost; (2) in protecting against erosion soils which ordinarily become badly washed from heavy fall and winter rains; and (3) in supplying good winter pasturage. Leguminous cover crops, besides giving the above values, add to the nitrogen in the soil. Cover crops should be turned under in the spring for green manure. The principal legumes used in the South for cover crops are crimson clover, bur clover, and vetch. It is a common practice to mix vetch with oats or rye for a winter cover crop.

24

When the system of farming or the condition of the soil is such as to make it desirable to devote one year in a rotation to soil improvement, selection may be made from a large number of legumes to use for green manure. Cowpeas, soy beans, velvet beans, lespedeza, peanuts, sweet clover, and alsike clover are all good and should be chosen for this use according to special adaptation to soil and climate.

25

## PRINCIPAL LEGUMINOUS CROPS FOR THE SOUTH.

## COWPEAS.

View. Cowpeas are grown more widely in the cotton region than any other leguminous crop. They are fairly well adapted to all types of soil, when well drained, and they make a good crop for either hay or pasture. Cowpeas are easily grown, and the seed is relatively inexpensive. They may be used to occupy the ground as a regular crop, but are also well adapted as a catch crop for pasturage or for green manure. When well cultivated, they leave the soil in good condition to harrow without plowing for grain or other crops.

26 There are many varieties of cowpeas, which vary considerably in habits of growth and time of ripening. The Whip-poorwill and the Groit are vigorous, upright growers and therefore well adapted for heavy yields of hay. Trailing varieties, like the Black, the Red Ripper, or the Unknown, are good for pasture and to leave on the ground during the winter for soil enrichment. Under each of these three names, however, various different varieties occur in the seed trade. The Iron and the Brabham are noted for their resistance to wilt and root knot, diseases which frequently occur, and they alone should be used where these pests are prevalent.

Cowpeas may be sown in rows or broadcast. The former method permits of cultivation, requires less seed, and usually gives better yields, while the latter way requires less labor. When sown in rows they should be from 3 to 4 feet apart, and from 2 to 3 pecks of seed per acre should be used. Sorghum or 27 corn is sometimes sown with cowpeas to be used for hay or silage. The cowpeas are held off the ground in this way, and the stalks keep the cut cowpeas loose, so that air is admitted more readily and the hay is easily cured.

Curing cowpea hay during a rainy season is difficult, and for this reason planting should be done at such times that the cowpeas will be ready to cut during the dry weather which is common in September and October in most parts of the South. The 28 hay should be cut when the pods begin to turn yellow, but cutting may be deferred till later in case of unfavorable weather. The ordinary mower is the best machine for cutting. When the vines are thoroughly wilted they should be turned with a tedder or pitchfork and may then remain for 24 hours or so before being raked into windrows. The hay should then be put into cocks and remain there until it is sufficiently cured for hauling to stack or barn. When the weather is especially favorable the curing may be done in the windrows, thereby



View.  
 saving the labor of cocking. If it gets wet in the windrow it should be spread out to dry as soon as the water has dried from the surface. A convenient device sometimes used for drying cowpea hay may be made with strips or poles 6 feet long joined at the top and held 4 feet apart at the bottom by means of crosspieces. The vines are piled upon this rack, which permits the air to circulate freely among the vines, thus curing them quickly and satisfactorily with little loss of leaves. The racks may be stored conveniently after using and will last for several seasons. Another device which accomplishes the purpose fairly well is made by nailing two crosspieces at right angles to each other near the bottom of a pole from 4 to 6 feet long, which is driven into the ground.

29

#### SOY BEANS.

The soy bean is a comparatively new crop in this country, but one which has fast gained favor in the South and North alike. The soy bean withstands dry weather well, and makes a hay similar in quality to that from cowpeas. It grows erect and holds its leaves better than cowpeas, but has a more fibrous stem. Soy beans produce heavier seed yields than cowpeas and the seeds are richer in feeding value. There are many different varieties, which vary in time of ripening from 90 days from sowing to the entire growing season. The Mammoth Yellow is the most commonly grown late variety for hay, but ripens its seed only south of the Potomac and Ohio Rivers. The Ito San is one of the best of early varieties, while the Haberlandt, Wilson, Tokyo, Medium Yellow, and Barchet are popular in certain sections.

30

Soy beans, like cowpeas, are sown broadcast or drilled, but, being erect, are well suited to cultivation in rows. Rows should be placed 3 or more feet apart and the seeding should be from  $1\frac{1}{2}$  to 2 pecks per acre. This quantity of seed should, of course, be increased for broadcasting. The seed should be planted not deeper than 2 inches, and as this is still a new crop in many places inoculation should be practiced. It is not well to plant soy beans near to woods, as rabbits are very fond of the plant.

31

If used for hay, soy beans should be cut when the first leaves begin to turn yellow; if for seed, the cutting should not be done until the leaves have nearly all fallen. The pods of many varieties shatter easily, and should be harvested as soon as ripe and in the morning, when the plants are wet with dew. Soy beans are harvested for hay in the same manner as cowpeas, but are cured with less difficulty. The hay is fully as nutritious as that from cowpeas and is relished by all farm animals.

32



- 33 Lespedeza is a self-seeding annual legume, which is spread over the entire cotton region except on the light sandy soils of Florida. It is universally used as late summer pasturage, but on fertile soils it makes such a heavy growth that it is profitably harvested for hay. On fields that have become barren and unproductive lespedeza will do much to restore the fertility of the soil, and it commonly appears, even if not sown.

Seeding should be done in late winter or early spring at the rate of about one-half bushel of seed per acre. When grown for hay it is commonly sown with oats, the oats being sown in September or October and the lespedeza in the following February or March, after first harrowing the ground. The principal part of the lespedeza plant is leaves, the stems being very slender. It makes a hay nearly equal to red clover or cowpeas in quality.

#### ALFALFA.

- 34 On land where it will succeed, alfalfa is one of the best crops for a permanent meadow, and is also valuable as a pasture plant. Alfalfa needs rich, well-drained land having a permeable subsoil and containing a good supply of lime. The black prairie region of Alabama and Mississippi, the alluvial sections along the Tennessee, Mississippi, and Red Rivers, northeastern Texas, and the region of the Rio Grande are all adapted to the production of alfalfa. Wherever the soil is of limestone origin or contains a high percentage of lime, alfalfa is nearly sure to succeed. Sandy soils and dry clay uplands have not proven satisfactory for alfalfa, neither does it thrive in the Gulf-coast region.

- 35 Many soils not naturally adapted to alfalfa have been made suitable by special treatment, and the acreage of this crop is increasing very fast as a result of the utilization of such areas. Some wet lands become suited to alfalfa when thoroughly drained. Lands newly drained and many other well-drained lands commonly need an application of lime for alfalfa. From 1 to 2 tons of burnt lime, 2 to 3 tons of slaked lime, or 3 to 4 tons of finely ground limestone per acre are good applications. A fertile soil well drained and well limed can generally be made to produce alfalfa. Where the soil is not fertile it is always advisable to improve it by the use of barnyard manure or green manure before sowing to this crop.

- 36 The seed bed should be thoroughly prepared before sowing alfalfa seed; that is, it should be finely pulverized, well compacted, and free from weeds. Well-cultivated fields of early

varieties of cowpeas or soy beans, early potatoes, or similar crops which mature early may be prepared easily for alfalfa, after harvesting these crops, without plowing the ground. A thorough disking with sufficient harrowing and rolling will fit the soil for sowing. From 25 to 30 pounds of alfalfa seed per acre should be sown and lightly covered. Seeding, in general, should be done in the fall from August to October, depending upon the climate and the condition of the soil. Fall seeding should always be done sufficiently early to permit a good growth before winter sets in. In most sections of the South fall sowing is best, since it avoids the worst injury from crab grass and other summer weeds. Where it is desired to sow fields following cotton the late harvesting of this crop makes it necessary to delay sowing the alfalfa until the following spring.

View.

In fields where alfalfa has not been grown for a few years inoculation should always be practiced.

Fall-sown alfalfa should yield from three to five cuttings the following season and average about 1 ton of cured hay per acre each cutting. There is no better hay than alfalfa for dairy, beef cattle, sheep, and young growing stock of all kinds. It is also a valuable feed for working animals, but care should be taken not to feed it excessively. It affords splendid pasturage for hogs, but care must be taken not to pasture it too closely nor too late in the season. In general, pasturing alfalfa is not to be recommended in the South, as the stand is frequently injured, then weeds thrive and invade the field.

37

#### MELILOTUS.

Melilotus, or sweet clover, grows luxuriantly in soil well supplied with lime. It is one of the greatest soil builders among leguminous plants. It grows vigorously on very thin land if lime is present, and if undisturbed, after being well seeded, will restore barren and depleted soils to a state of productivity.

38

Melilotus is abundant in the black-prairie region of the South, even where the lime rock is only thinly covered with soil.

There are three varieties of melilotus—the biennial white, the biennial yellow, and the annual yellow. The last named is of little value.

Melilotus generally should be sown in February and March at the rate of 20 pounds per acre of hulled or one-half bushel of unhulled seed. Both biennial varieties make a fairly good growth the first season, live through the winter, and mature

View.

- 39 seed the second season, after which the plant dies. After a field is once thoroughly seeded, both the first and the second year's growths occupy the ground each season.

- In Kentucky and other States of like latitude where *Melilotus* is well established it is common to pasture lightly until the second year's growth is approaching maturity, when the stock is removed and the crop is later cut as hay or allowed to mature as a seed crop. In States well to the South one cutting for hay is commonly made the first season after sowing and  
40 two or three cuttings during the second season. When cut early before the stems are hard and woody, *Melilotus* hay is of good quality and valuable for feeding. The flavor of the plant, however, both green and cured, is such that animals will rarely eat it until-trained to do so.

## RED CLOVER.

- 41 Red clover, which is a very prominent leguminous crop in the North, is not well adapted to the southern climate. However, on fairly fertile soils rich in lime, such as the alluvial and black prairie lands and well-drained river bottoms, red clover makes a good hay crop for one or two seasons.

- For the far South red clover should be sown about the middle of September on a thoroughly prepared seed bed. No nurse crop should be used in this section. In the northern part of the cotton belt seeding is sometimes successful when  
42 sown on grain fields in early spring. About 12 pounds of seed per acre should be used. When red clover yields well in the South, from two to three cuttings of hay of from 1 to 1½ tons each may be expected.

On some soils not well adapted to red clover a good application of lime frequently enables the crop to grow successfully.

## ALSIKE CLOVER.

- 43 In manner of growth alsike clover is midway between red clover and white clover. It will do fairly well on some soils where red clover fails for need of lime. It also grows on some soils which are too poorly drained for success with red clover. It is a good plant for use in mixed pastures, and under favorable conditions its growth is such as to produce fairly good yields for hay. The practice of mixing alsike and red clover is advisable.

## VETCHES.

The vetches are the strongest growing annual winter legumes and furnish splendid winter pasture and hay. Hairy

vetch and common vetch are both excellent to use in mixture with oats or rye winter pasture. Narrow-leaved vetch is best to use in permanent pasture mixtures. When used with winter oats or rye about 1 bushel of the grain and from 1 peck to a half bushel of vetch should be sown during September or October. Hairy vetch is hardier than common vetch but the seed is expensive. When grown for the first time on a field the soil should be inoculated.

View.

44

When pastured in winter, the stock should be removed from the vetch, or vetch mixture, fairly early in the spring to permit growth for a good cutting of hay, or covering of green manure. If cut when mature, enough of the vetch seed will often shell and scatter to reseed the soil.

#### CRIMSON CLOVER.

Crimson clover is a winter annual well adapted as a cover crop in sections where it does well. It is grown most abundantly on the coastal plain soils from New Jersey to South Carolina and near the coast still farther south. Its extent has increased very fast in late years and it is now grown in many States west of the Allegheny Mountains.

45

Crimson clover should be sown at the rate of 10 to 15 pounds per acre, from August to October, or when the first good autumn rains set in. It is commonly sown in corn or other cultivated crops following the last cultivation either just before or just after a penetrating rain. Inoculation should be practiced on fields where the crop has not been grown previously.

Crimson clover furnishes late fall and winter pasture of good quality and it is sometimes cut for hay in the spring. Its principal value, however, is to turn under for a green manure crop. It fits fairly well into the cotton-cropping system for this use.

#### BUR CLOVER.

Bur clover is a winter-growing legume which is adapted as a winter cover crop in the section from Tennessee and North Carolina southward. It does not furnish a hay crop but affords good winter and spring pasture for cattle, sheep, and hogs. When cleaned seed are used inoculation should be practiced, otherwise the particles of soil which the burs pick up carry sufficient bacteria for inoculation.

46

#### PEANUTS.

The use of peanuts is fast gaining ground throughout the South both for hay and for pasture. The crop does well on most sandy soils when they are plentifully supplied with



View.

- 47 lime. The Spanish variety is best adapted for use as hay and pasturage. The peanut is a legume which fits well into rotations with cotton or corn as principal crops. They are frequently planted in rows alternately with the rows of corn. About 2 bushels per acre should be planted, and in the northern part of the Southern States they should be shelled previous to planting. They make splendid pasturage for hogs, which eat both vines and nuts. They also make hay of good quality which is relished by both cattle and sheep.

#### FLORIDA BEGGAR WEED.

- 48 The Florida beggar weed is an annual forage plant adapted to the light sandy soils of Florida and southern Alabama and Georgia. Like crab grass, it develops late in the season, and so is very useful for pasturage when other pasture plants are at their poorest. When 20 to 30 pounds per acre of rough seed are sown after early crops, such as oats and melons, the beggarweed develops in time for a good late pasturage. It is fattening to horses, mules, and cattle. It is frequently cut for hay before getting woody and is likewise sometimes used for silage.

#### VELVET BEANS.

- 49 Velvet beans are a valuable leguminous crop in sections having long growing seasons. The crop takes from five to seven months to mature, which limits its usefulness to sections south of a line extending through Savannah, Ga., and Austin, Tex. Recently developed early varieties are valuable, however, farther northward. The extremely heavy growth of the velvet bean makes it a valuable legume for restoring fertility to the soil. The heavy growth also makes it necessary to provide some means of support for the plant for best results. Such support is practically supplied by planting it with corn or pearl millet. With corn it is planted in the same or alternate rows at the same time the corn is planted. From 8 to 12 quarts of seed per acre are usually planted. When well supported a good crop of velvet beans commonly yields as high as 50 to 75 bushels of seed per acre; it furnishes a good fall and early winter pasture for cattle and hogs, for which it is most commonly used.
- 50



## APPENDIX.

### LANTERN SLIDES.

No. of  
view.

- 6785-C 1. Cotton and timothy sections map of the United States.
- 9799-B 2. Characteristic blossoms and pods of legumes.
- J.C.G. 103013. Nodules on soy-bean roots.
- 9798-B 4. Cross section of nodule of lupine  $\times 46$ . Bacteria from alfalfa nodule  $\times 1,000$ .
- 9632-B 5. Field of soy beans—plants which can get nitrogen directly from the air.
- 6786-C 6. Nitrogen in some farm produce.
- J.C.G. 107647. Soy beans, showing effect of inoculation.
- 9367-B 8. Collecting soil from sweet-clover field for inoculating.
- 5307-C 9. Liquid cultures of legume bacteria.
- J.C.G. 112340. Legumes and profitable farming.
- J.M. 8881 11. Corn following alfalfa. Two years in alfalfa, on the right; one year, on the left.
- J.M. 5158 12. Crimson clover in cotton at last cultivation.
- J.M. 6862 13. Cowpeas between rows of corn. Thin, sandy land.
- P.+H. 11086 14. Peanuts planted alternately with rows of corn. Cover crop should follow.
- J.M. 5977 15. Hairy vetch seeded with winter oats.
- 9920-B 16. Corn, wheat, clover, and cows—a practical rotation.
- 9631-B 17. Cutting soy beans and following with wheat drill.
- 6001-C 18. Feeding value of legumes.
- 9638-B 19. Steers on clover pasture.
- J.C.G. 12660 20. Plowing under cowpeas for green manure.
- J.C.G. 8290 21. A crop of corn and a green manure. Cowpeas sown at last cultivation of corn.
- J.C.G. 11245 22. Field peas as a catch crop following wheat.
- 3356-C 23. Pasturing the catch crop before turning under for green manure.
- J.M. 6868 24. Cover crop of hairy vetch seeded at last cultivation of corn.
- 9637-B 25. A good green-manure crop, cowpeas.
- J.C.G. 2964 26. A good field of Whippoorwills.
- J.C.G. 10773 27. Mixture of Black cowpeas and Amber sorghum.
- J.C.G. 4469 28. Harvesting cowpeas, seeded broadcast, tangle of vines.
- 9635-B 29. A convenient rack for curing cowpea hay.
- 9636-B 30. Cowpeas on left, soy beans on right.
- J.M. 9758 31. Soy beans are well adapted to cultivation.
- J.C.G. 7796 32. Soy beans for seed, Peking variety.
- J.M. 3814 33. Lespedeza hay, showing cocks covered with canvas.
- J.M. 5448 34. A good field of alfalfa, Kentucky.
- 9373-B 35. Limed and unlimed fields, Kentucky.
- J.M. 7166 36. The pulverizer is a valuable tool in preparing a seed bed.
- 9633-B 37. Alfalfa hay in process of curing.

- F.C.G.* 8151 38. *Melilotus alba*, showing ability to succeed in practically pure gravel bed alongside road.
- F.C.G.* 8266 39. Stand of self-seeded *Melilotus* from original seeding nine years previous. on typical run-down field, Falmouth, Ky.
- F.C.G.* 11256 40. Mowing white sweet clover for hay. Not yet in bloom.
- F.C.G.* 7784 41. Red clover plant.
- F.M.* 8625 42. A good field of clover hay.
- F.M.* 7204 43. A fine stand of alsike clover.
- F.C.G.* 9873 44. Hairy vetch and rye. The rye holds the vetch well off the ground.
- F.M.* 5189 45. Crimson clover, showing the most advanced stage of ripening which it is allowable to use for hay.
- F.C.G.* 7711 46. Bur clover.
- 6166-0* 47. A good field of Spanish peanuts.
- F.C.G.* 6837 48. Beggarweed.
- F.C.G.* 8885 49. Velvet bean, cluster of pods.
- F.C.G.* 8313 50. Velvet beans grown with corn.

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